LEVEL II

SUSQUEHANNA RIVER BASIN

WEST BRANCH OF TROUT CREEK, BRADFORD COUNTY

PENNSYLVANIA

GALVIN POND DAM

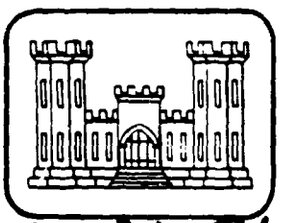
NDI No. PA 00602

PennDER No. 8-63

Dam Owner: Mr. Walter Kirby

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM



DACW31-81-C-0011

prepared for

DEPARTMENT OF THE ARMY

Baltimore District, Corps of Engineers

Baltimore, Maryland 21203

prepared by

MICHAEL BAKER, JR., INC.

Consulting Engineers

4301 Dutch Ridge Road

Beaver, Pennsylvania 15009

June 1981

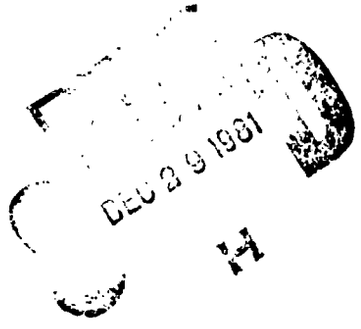
PREFACE

This report is prepared under guidance contained in the "Recommended Guidelines for Safety Inspection of Dams," for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Galvin Pond Dam, Bradford County, Pennsylvania
NDI No. PA 00602, PennDER No. 8-63
West Branch of Trout Creek
Inspected 31 October 1980

ASSESSMENT OF GENERAL CONDITIONS

Galvin Pond Dam is owned by Mr. Walter Kirby and is classified as a "Significant" hazard - "Small" size dam. The dam was found to be in fair overall condition at the time of inspection.

Hydraulic/hydrologic evaluation, performed in accordance with procedures established by the Baltimore District, Corps of Engineers, revealed that the spillway capacity is less than the peak inflow to the impoundment during the 100-year flood.

A spillway design flood (SDF) in the range of the 100-year flood to the 1/2 Probable Maximum Flood (1/2 PMF) is required for Galvin Pond Dam. Because the dam is on the low end of the "Small" size category in terms of storage capacity and height, the 100-year flood was chosen as the SDF. The spillway is therefore considered "Inadequate."

Several items of remedial work should be immediately initiated by the owner. These include:

1) Develop remedial measures to ensure that the dam is not overtopped by the 100-year flood.

2) Repair the two 12-inch steel pipes, fill the embankment to original crest elevation and reseed with grass.

3) Cut the trees and brush on the dam.

4) Provide means to draw down the reservoir during an emergency.

In addition, the following operational measures are recommended to be undertaken by the owner:

1) Develop a detailed emergency operation and warning system.

2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.

3) When warning of a storm of major proportions is given by the National Weather Service, activate the emergency operation and warning system.

It is further recommended that formal inspection, maintenance, and operation procedures and records be developed and implemented. These should be included in a formal maintenance and operations manual for the dam.

Submitted by:

MICHAEL BAKER, JR., INC.

John A. Dziubek, P.E.
Engineering Manager-Geotechnical

Date: 26 June 1981

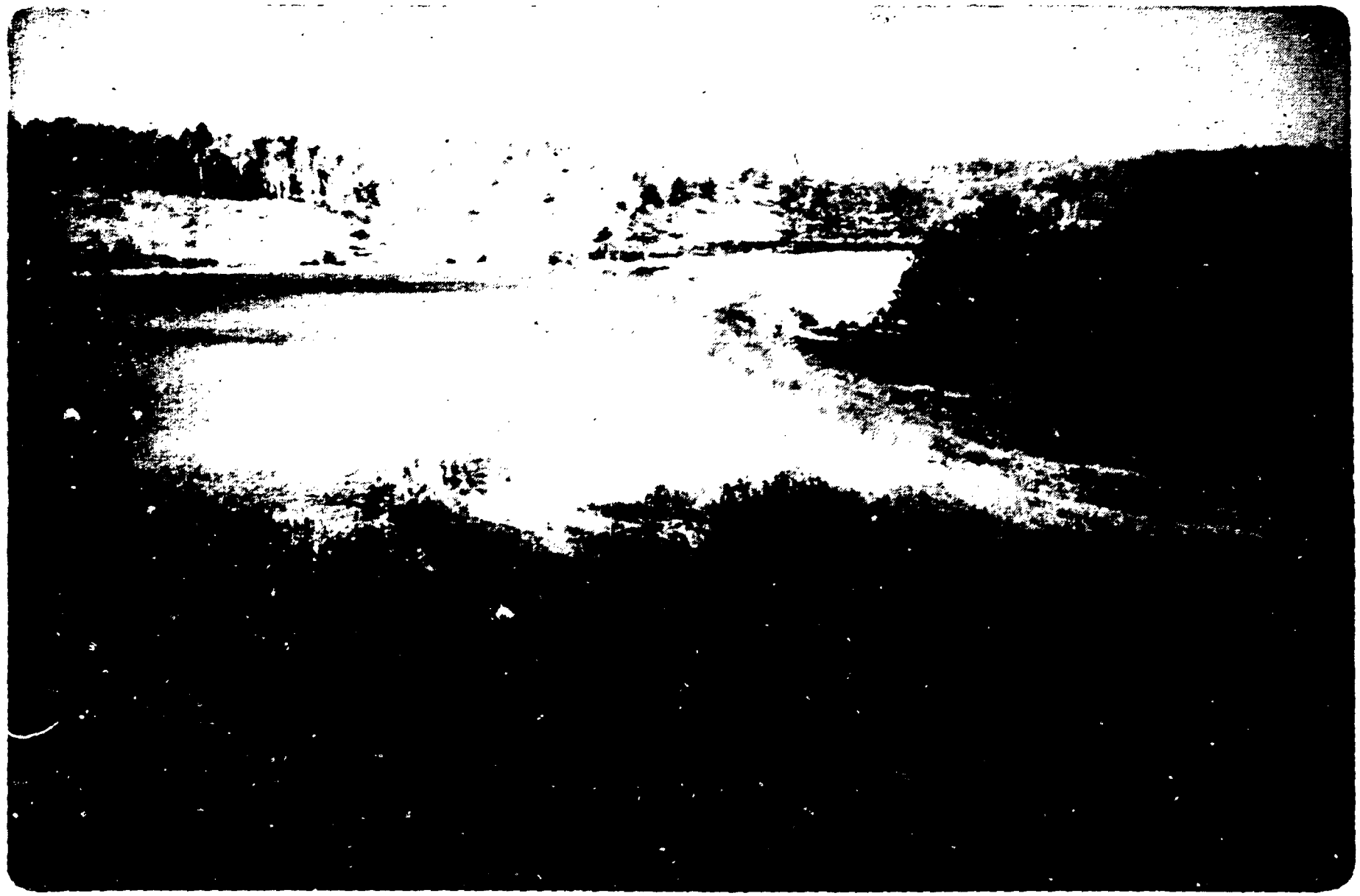
Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
Commander and District Engineer

Date: 7 Jul 81

GALVIN POND DAM



Overall View of Dam From Right Abutment

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NATIONAL DAM INSPECTION PROGRAM
GALVIN POND DAM
NDI No. PA 00602, PennDER No. 8-63

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority - The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose of Inspection - The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances - Galvin Pond Dam is an earthfill embankment approximately 794 feet long and 13.5 feet high. The embankment has a crest width of 16 feet and side slopes of 2.1H:1V (Horizontal to Vertical) upstream and 4.0H:1V downstream. There was no information available on possible zoning of the embankment.

The spillway, located near the right abutment, consists of two adjacent 12-inch diameter steel pipes with the same inlet and outlet elevation and one cast iron pipe with an inlet and outlet elevation 6 inches lower than the steel pipes. The invert of the inlet of the cast iron pipe is about 2 feet below the minimum crest of dam. All three pipes are 35 feet long and extend through the embankment.

There were no facilities observed for dewatering the reservoir.

b. Location - Galvin Pond Dam is located on the West Branch of Trout Creek, approximately 1.5 miles north of Middletown, Pennsylvania. The structure is located in Ridgebury Township, Bradford County, Pennsylvania. Coordinates for the dam are N 41° 56.9' and W 76° 41.6'. The dam and reservoir can

be located on the USGS 7.5 minute topographic quadrangle, Bentley Creek, Pennsylvania.

c. Size Classification - The height of the dam is 13.5 feet and the reservoir volume is 110 acre-feet to the top of dam [Elevation 1538.5 feet Mean Sea Level (ft. M.S.L.)]. The dam is therefore in the "Small" size category.

d. Hazard Classification - There are two houses and a garage located 1.5 miles downstream from the dam. These structures range from less than 5 feet above the streambed to approximately 10 feet above the streambed. Due to the distance of these structures from the dam, loss of life is not likely in the event of dam failure. However, these structures would likely suffer economic damage from failure of the dam. Therefore, this dam is considered in the "Significant" hazard category.

e. Ownership - The dam is owned by Mr. Walter Kirby, 126 Valley Road, Media, Pennsylvania 19063.

f. Purpose of Dam - The dam and reservoir are used for recreational purposes.

g. Design and Construction History - The dam was built in 1966. The contractor was the Galvin Brothers, who sold the dam to Mr. Walter Kirby. There was no construction plan or design information available to review.

1.3 PERTINENT DATA

a. Drainage Area (square miles) - 0.30

b. Discharge at Dam Site (c.f.s.) -

Maximum Flood	Unknown
Spillway Capacity at Maximum Pool (El. 1538.5 ft. M.S.L.) -	11.7

c. Elevation* (feet above Mean Sea Level [ft. M.S.L.]) -

Design Top of Dam -	Unknown
Minimum Top of Dam -	1538.5
Maximum Design Pool -	Unknown
Spillway Invert -	1536.5
Streambed at Toe of Dam -	1525.0
Maximum Tailwater of Record -	Unknown

*All elevations are referenced to the spillway invert El. 1536.5 ft. M.S.L., as estimated from the USGS 7.5 minute topographic quadrangle, Bentley Creek, Pennsylvania.

d. Reservoir (feet) -

Length of Maximum Pool (El. 1538.5 ft. M.S.L.) -	1025
Length of Normal Pool (El. 1536.5 ft. M.S.L.) -	950

e. Storage (acre-feet) -

Top of Dam (El. 1538.5 ft. M.S.L.) -	110
Normal Pool (El. 1536.5 ft. M.S.L.) -	74

f. Reservoir Surface (acres) -

Top of Dam (El. 1538.5 ft. M.S.L.) -	19.5
Normal Pool (El. 1536.5 ft. M.S.L.) -	17

g. Dam -

Type - Earthfill	
Total Length Including Spillway	794
Height (feet) - Design -	Unknown
Field -	13.5
Top Width (feet) -	16
Side Slopes - Upstream -	2.1H:1V
Downstream -	4.0H:1V
Zoning -	None
Impervious Core -	None
Cut-off -	None
Drains -	None

h. Diversion and Regulating Tunnels - None

i. Spillway -

Type - Two steel and one cast iron 12-inch diameter pipes, 35 feet long, extending through embankment.

Location - Right side of embankment.	
Invert Elevation (ft. M.S.L.) -	1536.5
Gates -	None
Downstream Channel - Riprapped trapezoidal channel 100 feet long.	

j. Outlet Works - None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

There was no information available in the Pennsylvania Department of Environmental Resources (PennDER) File No. 8-63 for the dam. Information was obtained by field observation and discussion with the owner.

2.2 CONSTRUCTION

The dam was constructed in 1966 without the owner/contractor obtaining a permit for construction. The contractor was the Galvin Brothers. There was no other information available about the construction of this dam.

2.3 OPERATION - The owner, Walter Kirby, is responsible for all operations and maintenance.

2.4 EVALUATION

a. Availability - There was no construction plan or design information available to review.

b. Adequacy - The information obtained in the field and from discussion with the owner is adequate for a Phase I Inspection of the dam.

c. Validity - There is no reason to doubt the validity of the available information.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General - The dam was found to be in fair overall condition at the time of inspection on 31 October 1980. No unusual weather conditions were experienced during the inspection. Noteworthy deficiencies observed during the visual inspection are described briefly in the following paragraphs. The complete visual inspection checklist, field sketch, top of dam profile, and typical cross-section are given in Appendix A.

b. Dam - There are some small trees and brush growing along the upstream shoreline and on the downstream slope. The right end of the dam is approximately 6 inches lower than the average top of dam elevation.

c. Appurtenant Structures - There were depressions present in the embankment above the two 12-inch steel pipes. These depressions probably indicate disjointed pipes which should be repaired and the embankment filled to original crest elevation.

d. Reservoir - The reservoir slopes are moderate with no signs of instability. The slopes are forested except for the grass-covered left reservoir slope. Sedimentation is not considered to be a significant problem in this reservoir.

e. Downstream Channel - There are two homes and one garage located 1.5 miles downstream from the dam which may suffer economic damage in the event of a failure of the dam.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no formal written instructions for lowering the reservoir or evacuating the downstream area in case of an emergency.

It is recommended that formal emergency procedures be prepared. A plan to dewater the reservoir in the event of an emergency should be developed.

4.2 MAINTENANCE OF DAM

The owner, Walter Kirby, is responsible for maintenance of the dam. Maintenance of the dam has been performed on an as-needed basis. It is recommended that formal written maintenance procedures be developed and implemented.

4.3 MAINTENANCE OF OPERATING FACILITIES

There are no operating facilities on the dam. An emergency drawdown plan should be developed in case an emergency drawdown should become necessary.

4.4 DESCRIPTION OF ANY WARNING SYSTEM

There is no warning system in the event of a dam failure. An emergency warning system should be developed.

4.5 EVALUATION OF OPERATIONAL ADEQUACY

The current operational features are adequate for the purpose they serve. However, it is recommended that a formal maintenance and operations manual be prepared for the dam.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data - No hydrologic or hydraulic design calculations are available for Galvin Pond Dam.

b. Experience Data - No information concerning the effects of significant floods on the dam is available.

c. Visual Observations - During the visual inspection, no problems were observed which would indicate that the dam and appurtenant facilities could not perform satisfactorily during a flood event.

d. Overtopping Potential - Galvin Pond Dam is classified as a "Significant" hazard - "Small" size dam requiring evaluation for a spillway design flood (SDF) in the range of the 100-year flood to the 1/2 Probable Maximum Flood (1/2 PMF). Since the dam is on the low end of the "Small" size category, based on height and storage capacity, the 100-year flood was chosen as the SDF.

Using material from "The Hydrologic Study - Tropical Storm Agnes", prepared by the Corps of Engineers in New York City, the peak inflow to the impoundment for the 100-year flood was calculated to be 690 c.f.s. The peak inflow to the impoundment for the 100-year flood was also calculated to be 230 c.f.s. using material from Water Resources Bulletin, Bulletin No. 13, Floods in Pennsylvania", prepared by the Department of Environmental Resources, Commonwealth of Pennsylvania. Averaging these two methods produced a peak inflow of 461 c.f.s. which was used in this analysis.

The spillway capacity at the minimum top of the dam is 11.7 c.f.s., which is approximately 2.5 percent of the peak inflow to the impoundment.

e. Spillway Adequacy - As outlined in the above analysis, the inflow to the impoundment during the 100-year flood is greater than spillway capacity; therefore, the spillway is considered "Inadequate."

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations - There were no structural inadequacies noted during the visual inspection that cause concern for the structural stability of the dam.

b. Design and Construction Data - Design calculations were not available for review. Because of the low height of the dam, the moderate slopes and total width of the embankment, and because no signs of distress or steady state of seepage were observed; no further stability analysis is deemed necessary for this Phase I Inspection Report.

c. Operating Records - Nothing in the operational information indicates concern relative to the structural stability of the dam.

d. Post-Construction Changes - No other changes adversely affecting the structural stability of the dam have been performed.

e. Seismic Stability - The dam is located in Zone 1 on the "Seismic Zone Map of the Contiguous United States," Figure 1, page D-30, "Recommended Guidelines for Safety Inspection of Dams." This is a zone of minor seismic activity, and therefore, further consideration of the seismic stability is not warranted.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety - Galvin Pond Dam was found to be in fair overall condition at the time of inspection. Galvin Pond Dam is a "Significant" hazard - "Small" size dam requiring a spillway capacity in the range of the 100-year flood to the 1/2 PMF. Because the dam is on the low end of the "Small" size category in terms of height and storage capacity, the 100-year flood was chosen as the SDF. As presented in Section 5, the spillway capacity is less than the peak inflow to the impoundment during the 100-year flood. Therefore, the spillway is considered "Inadequate."

b. Adequacy of Information - The information available and the observations made during the visual inspection are considered sufficient for a Phase I Inspection Report.

c. Urgency - The owner should immediately implement the recommendations discussed in paragraph 7.2.

d. Necessity for Additional Data/Evaluation - The hydraulic/hydrologic analysis performed in connection with this Phase I Inspection Report has indicated the need for additional spillway capacity.

7.2 RECOMMENDATIONS/REMEDIAL MEASURES

The inspection revealed certain items of remedial work which should be performed by the owner without delay. These include:

1) Develop remedial measures to ensure that the dam is not overtopped by the 100-year flood.

2) Repair the two 12-inch steel pipes, fill the embankment to original crest elevation and reseed with grass.

3) Cut the trees and brush on the dam.

4) Provide means to draw down the reservoir during an emergency.

In addition, the following operational measures are recommended to be undertaken by the owner:

1) Develop a detailed emergency operation and warning system.

2) During periods of unusually heavy rain, provide around-the-clock surveillance of the dam.

3) When warning of a storm of major proportions is given by the National Weather Service, activate the emergency operation and warning system.

It is further recommended that formal inspection, maintenance and operation procedures and records be developed and implemented. These should be included in a formal maintenance and operations manual for the dam.

APPENDIX A

VISUAL INSPECTION CHECK LIST, FIELD SKETCH, TOP OF DAM PROFILE, AND TYPICAL CROSS-SECTION

Check List
Visual Inspection
Phase 1

Name of Dam Galvin Pond Dam County Bradford State PA Coordinates Lat. N 41°56.9'
Long. W 76°41.6'

NDI # PA 00602
PennDER # 8-63

Date of Inspection 31 October 1980 Weather Sunny Temperature 50° F.

Pool Elevation at Time of Inspection 1536.4 ft. M.S.L.* Tailwater at Time of Inspection 1525.0 ft. M.S.L.

*All elevations referenced to assumed spillway invert elevation 1536.5 ft. M.S.L. from USGS 7.5 minute topographic quadrangle, Bentley Creek, Pennsylvania.

Inspection Personnel:

Michael Baker, Jr., Inc.:

James G. Ulinski
Wayne D. Lasch
Jeffrey S. Maze

Owner's Representatives:

James G. Ulinski Recorder

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: GALVIN POND DAM

NDI # PA 00602

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
LEAKAGE		
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS		
DRAINS		
WATER PASSAGES		
FOUNDATION		

CONCRETE/MASONRY DAMS - Not Applicable

Name of Dam: GALVIN POND DAM

NDI # PA 00602

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES		
STRUCTURAL CRACKING		
VERTICAL AND HORIZONTAL ALIGNMENT		
MONOLITH JOINTS		
CONSTRUCTION JOINTS		

EMBANKMENT

Name of Dam GALVIN POND DAM

NDI # PA 00602

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed	

EMBANKMENT

Name of Dam GALVIN POND DAM

NDI # PA 00602

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The minimum top of dam elevation is only slightly above the spillway outlet pipes. This area is approximately 6 in. below the average top of dam.	Fill this low area and reseed with grass.
RIPRAP FAILURES	None observed	
VEGETATION	There are some small trees growing on the downstream slope and along the upstream shoreline.	Cut the trees.

EMBANKMENT

Name of Dam GALVIN POND DAM

NDI # PA 00602

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems observed.	
ANY NOTICEABLE SEEPAGE	None observed	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

OUTLET WORKS - Not Applicable

Name of Dam: GALVIN POND DAM

NDI # PA 00602

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT		
INTAKE STRUCTURE		
OUTLET STRUCTURE		
OUTLET CHANNEL		
EMERGENCY GATE		

UNGATED SPILLWAY

Name of Dam: GALVIN POND DAM

NDI # PA 00602

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SPILLWAY CONDUITS	The spillway consists of one 12 in. C.I.P. and two 12 in. steel pipes located near the right abutment. The embankment above the two 12 in. steel pipes has depressions, giving the impression that the pipes are probably disjointed.	The pipes should be repaired and the embankment filled to original crest level and re-seeded with grass.
APPROACH CHANNEL	The reservoir forms the approach to the pipes. At the time of inspection, the water level was down and the approach channel was vegetated.	
DISCHARGE CHANNEL	A riprap (rock rubble) lined channel forms the discharge channel. This channel is well vegetated but this vegetation should not obstruct the amount of flow from the conduits.	
BRIDGE AND PIERS	Not Applicable	

GATED SPILLWAY - Not Applicable

Name of Dam: GALVIN POND DAM

NDI # PA 00602

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL		
APPROACH CHANNEL		
DISCHARGE CHANNEL		
BRIDGE AND PIERS		
GATES AND OPERATION EQUIPMENT		

INSTRUMENTATION - None

Name of Dam: GALVIN POND DAM

NDI # PA 00602

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS		
OBSERVATION WELLS		
WEIRS		
PIEZOMETERS		
OTHER		

RESERVOIR

Name of Dam: GALVIN POND DAM

NDI # PA 00602

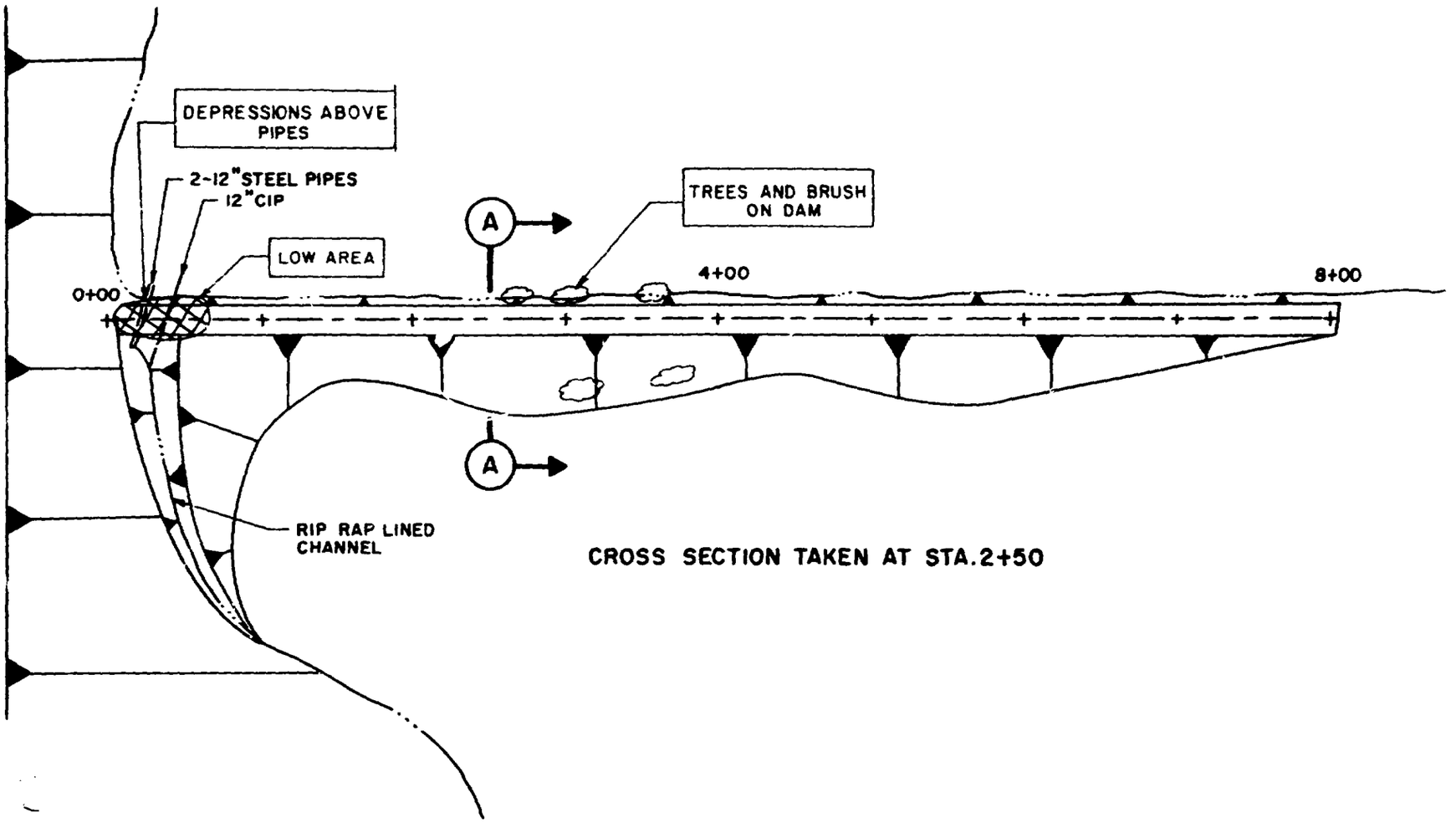
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The reservoir slopes are moderate (5°-15°) with no signs of instability. The slopes are forested except for the left side of the reservoir which is covered with grass.	
SEDIMENTATION	The amount of sedimentation is not known. Sedimentation is not considered to have a significant effect on this reservoir during flood events.	

DOWNSTREAM CHANNEL

Name of Dam: GALVIN POND DAM

NDI # PA 00602

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is riprap (rock rubble) lined with high and thick vegetation. This vegetation is not considered to have an effect on flow from the spillway.	
SLOPES	The downstream channel averages approximately 4% to the downstream hazard area.	
APPROXIMATE NO. OF HOMES AND POPULATION	There are two houses and one garage 1.5 miles downstream from the dam which may suffer economic damage in the event of a dam failure. No road crossings are present prior to this damage center.	



FIELD SKETCH
GALVIN POND DAM
NDI NO. PA 00602
PennDER NO. 8-63
SCHEMATIC - NOT TO SCALE

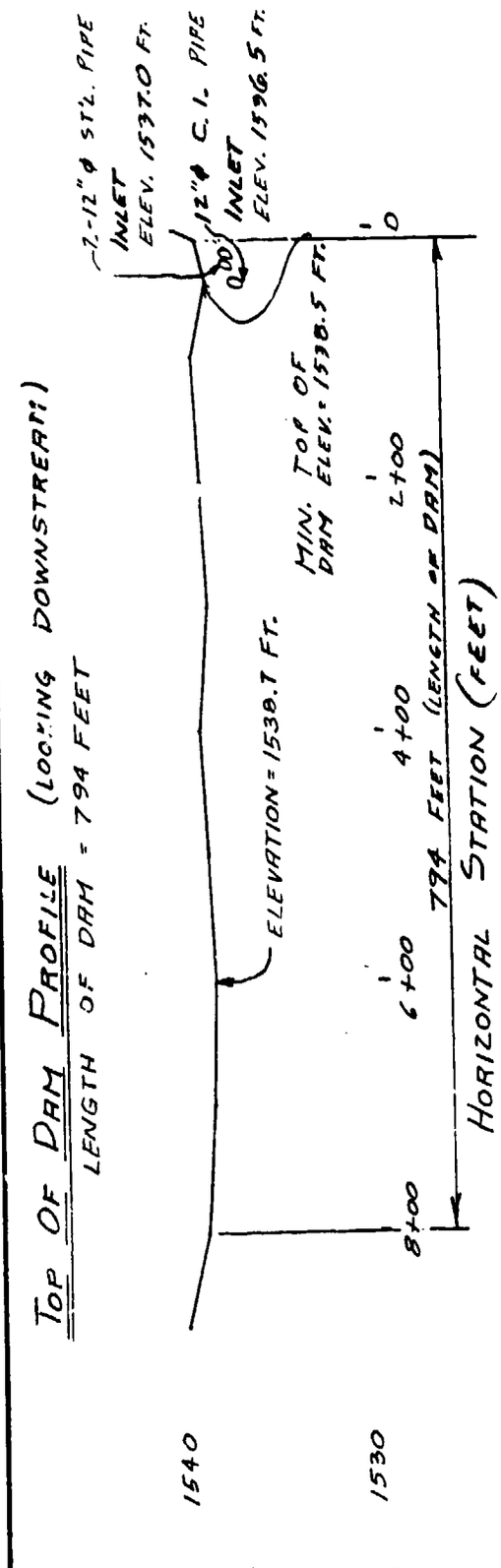
MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

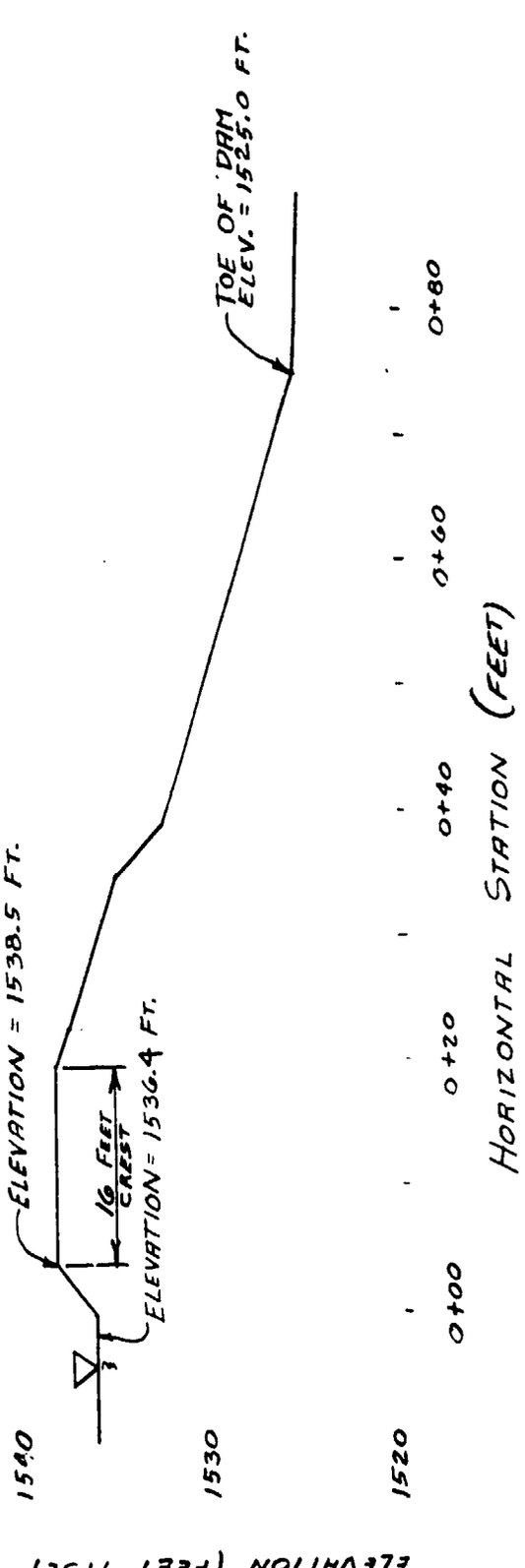
Box 280
Beaver, Pa. 15009

GALVIN POND DAM

TOP OF DAM PROFILE
TYPICAL CROSS-SECTION

DATE OF INSPECTION: 31 October 19[illegible]





APPENDIX B

ENGINEERING DATA CHECK LIST

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: GALVIN POND DAM
NDI # PA 00602

ITEM	REMARKS
PLAN OF DAM	None available. See Field Sketch (Plate 3) of this report for a general plan of the dam.
REGIONAL VICINITY MAP	A USGS 7.5 minute topographic quadrangle, Bentley Creek, Pennsylvania was used to prepare the vicinity map which is enclosed in this report as the Location Plan (Plate 1).
CONSTRUCTION HISTORY	The dam was built in 1966. The contractor was the Galvin Brothers. There was no information available about the design or construction of this dam.
TYPICAL SECTIONS OF DAM	None available. See the typical cross-section from the visual inspection, included in this report as Plate 4.
HYDROLOGIC/HYDRAULIC DATA	No information available.
OUTLETS - PLAN	No information available.
- DETAILS	No information available.
- CONSTRAINTS	No information available.
- DISCHARGE RATINGS	No information available.
RAINFALL/RESERVOIR RECORDS	None available

Name of Dam: GALVIN POND DAM
NDI # PA 00602

ITEM	REMARKS
DESIGN REPORTS	No information available.
GEOLOGY REPORTS	No information available. The Regional Geology is presented as Appendix F of this report.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No information available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	No information available.
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	No information available.

Name of Dam: GALVIN POND DAM
NDI # PA 00602

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	No information available.
HIGH POOL RECORDS	No information available.
POST-CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None reported in the information available.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported in the information available.
MAINTENANCE OPERATION RECORDS	No formal records are maintained.

Name of Dam: GALVIN POND DAM

NDI # PA 00602

ITEM	REMARKS
SPILLWAY PLAN, SECTIONS, and DETAILS	No information available.
OPERATING EQUIPMENT PLANS & DETAILS	No information available.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 0.30 sq.mi., moderately sloping terrain, half cleared and half forested land.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1536.5 ft. M.S.L. (74 ac.-ft.)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1538.5 ft. M.S.L. (110 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1538.5 ft. M.S.L. (minimum top of dam elevation)

SPILLWAY: One 12 in. diameter cast iron pipe and two 12 in. diameter steel pipes.

a. Invert Elevation 1536.5 ft. M.S.L. and 1537.0 ft. M.S.L.
b. Type 3 metal pipes.
c. Length of Pipes 35 ft.
d. Length of Crest Perpendicular to Flow Not Applicable
e. Location Spillover Right end of embankment.
f. Number and Type of Gates None

OUTLET WORKS: None

a. Type
b. Location
c. Entrance Inverts
d. Exit Inverts
e. Emergency Drawdown Facilities

HYDROMETEOROLOGICAL GAGES: None

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE No records available.

APPENDIX C

PHOTOGRAPH LOCATION PLAN AND PHOTOGRAPHS

DETAILED PHOTOGRAPH DESCRIPTIONS

Overall View - Overall View of Dam from Right Abutment

Photograph Location Plan

Photo 1 - View of Dam from End of Left Shoreline

Photo 2 - View Along Crest of Dam from Left End

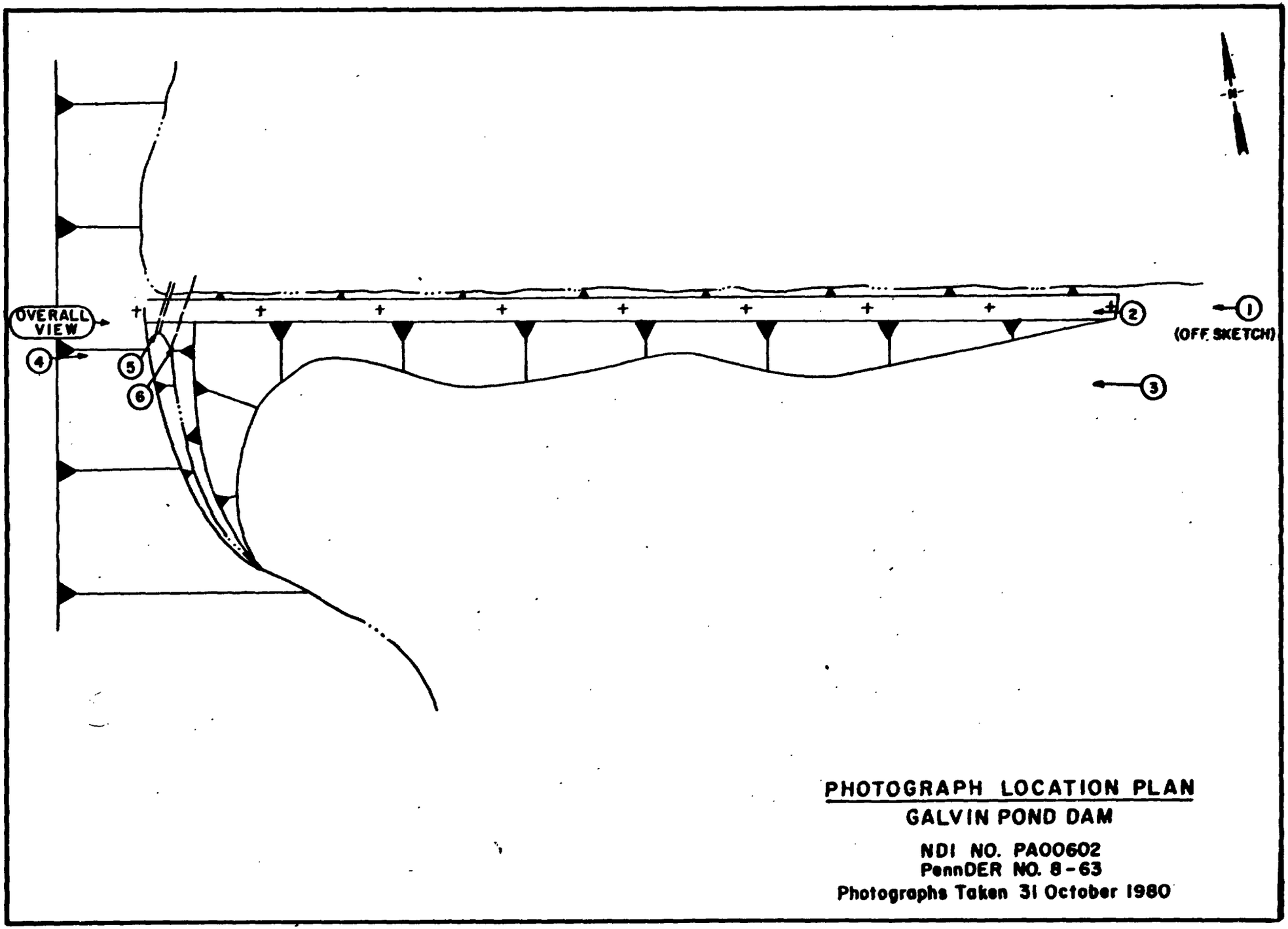
Photo 3 - View of Downstream Slope of Dam from Left Abutment

Photo 4 - View of Downstream Slope of Dam from Right Abutment

Photo 5 - View of Discharge End of Twin 12-inch Steel Pipes

Photo 6 - View of Discharge End of 12-inch Cast Iron Pipe

Note: Photographs were taken on 31 October 1980.



PHOTOGRAPH LOCATION PLAN

GALVIN POND DAM

NDI NO. PA00602
PennDER NO. 8-63
Photographs Taken 31 October 1980

GALVIN POND DAM

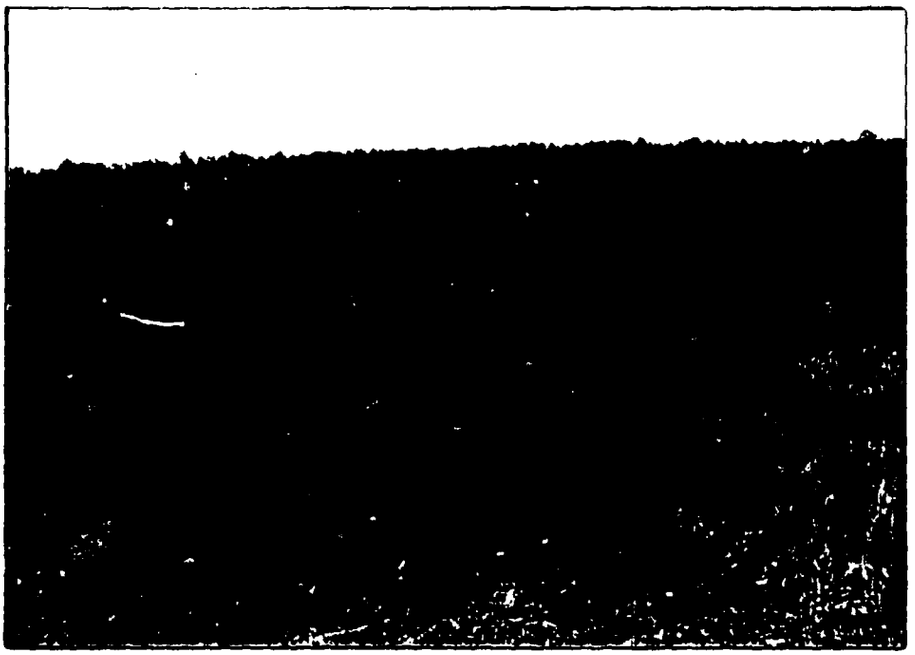


PHOTO 1. View of Dam from End of Left Shoreline

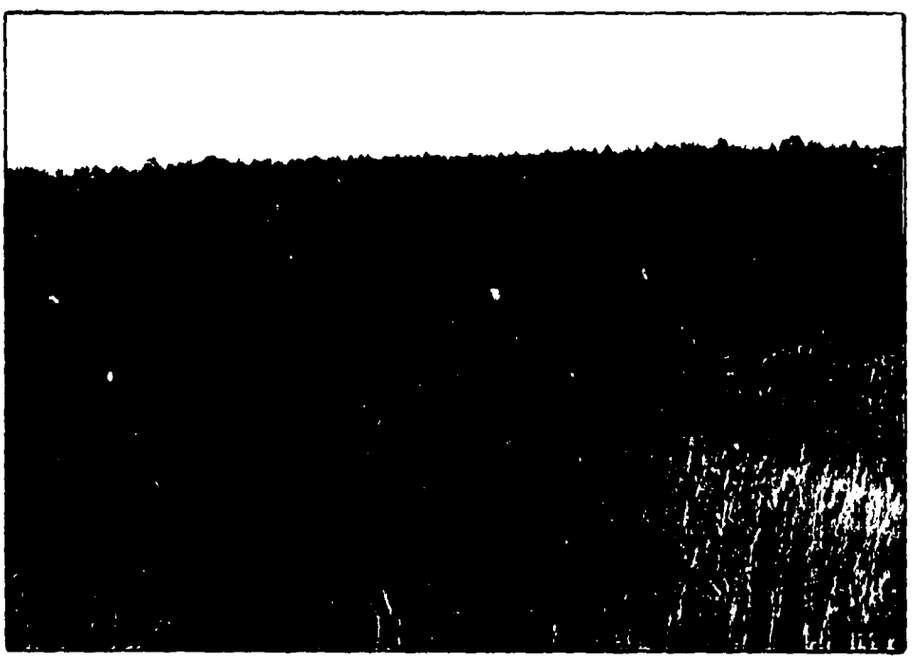


PHOTO 2. View Along Crest of Dam from Left End

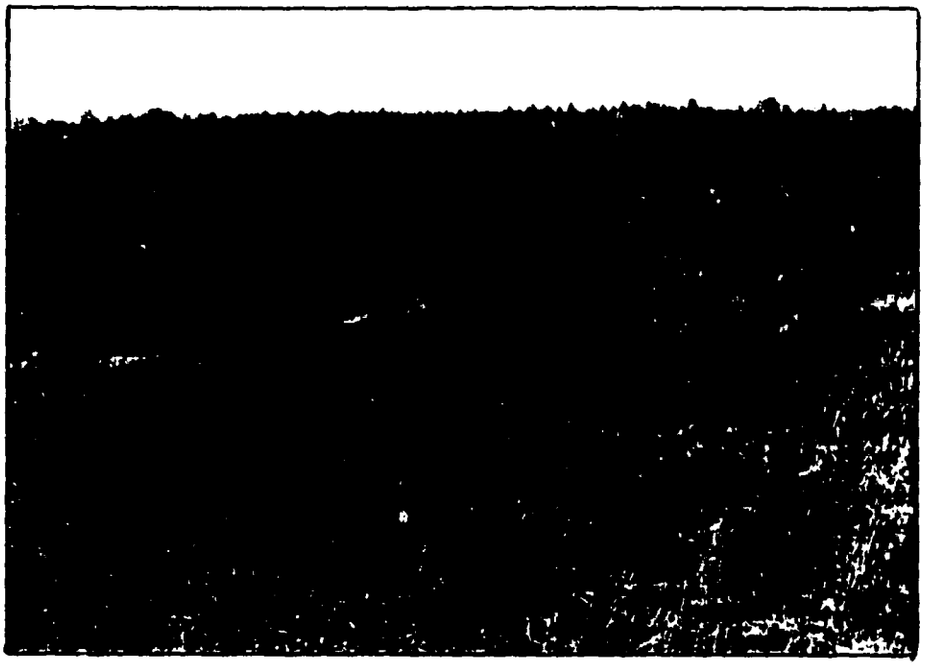


PHOTO 3. View of Downstream Slope of Dam from Left Abutment

PHOTO 4. View of Downstream Slope of Dam from Right Abutment

PHOTO 5. View of Discharge End of Twin 12-inch Steel Pipes
NOTE: There was no flow from either pipe during the visual inspection. What might appear to be muddy discharge from the right pipe in the photo is actually a weed in front of the camera.

PHOTO 6. View of Discharge End of 12-inch Cast Iron Pipe

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject GALVIN POND DAM S.O. No.
APPENDIX D - HYDROLOGIC Sheet No. of
AND HYDRAULIC COMPUTATIONS Drawing No.
Computed by Checked by Date

PREFACE

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

The conclusions presented pertain to present conditions, and the effect of future development on the hydrology has not been considered.

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: GALVIN POND DAM

100-YEAR RAINFALL = 5.7 INCHES/24 HOURS[1]

STATION	1	2	3	4	5
Station Description	GALVIN POND DAM				
Drainage Area (square miles)	0.30				
Cumulative Drainage Area (square miles)	0.30				
Adjustment of PMF for Drainage Area (%)[1]					
6 Hours					
12 Hours					
24 Hours					
48 Hours					
72 Hours					
Spillway Data					
Crest Length (ft)	SPILLWAY DISCHARGE				
Freeboard (ft)	RATING CURVE				
Discharge Coefficient	DEVELOPED ON				
Exponent	SHEETS 5 - 11				

[1] Technical Paper No. 40, Cooperative Studies Section, U.S. Weather Bureau, Washington, D.C., 1961.

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS
Box 280
Beaver, Pa. 15009

Subject GALVIN POND DAM — S.O. No.
HYDRAULIC DATA — Sheet No. 2 of 13
Drawing No.
Computed by GWT — Checked by — Date 12-2-80

STORAGE CALCULATIONS

AREA VS. ELEVATION DATA (MEASURED FROM QUADS)

ELEVATION (FT)	SURFACE AREA (ACRES)
1537.0	17.28
1540	20.74
1560	32.58

NORMAL POOL STORAGE

STORAGE VOLUME = $V_{NP} = h/3\,(A_1 + A_2 + \sqrt{A_1 A_2})$

h = ESTIMATED AVERAGE DEPTH = 5 FT.
A_1 = SURFACE AREA OF NORMAL POOL = 17.28 Ac.
A_2 = SURFACE AREA OF RESERVOIR BOTTOM = 13.30 Ac.
(ESTIMATED FROM AVERAGE DEPTH AND RESERVOIR SIDE SLOPES)

NORMAL POOL STORAGE = $V_{NP} = \frac{4.9}{3}\,(17.28 + 13.30 + \sqrt{(17.28)(13.30)})$

$V_{NP} = 74.71$ Ac.-Ft.

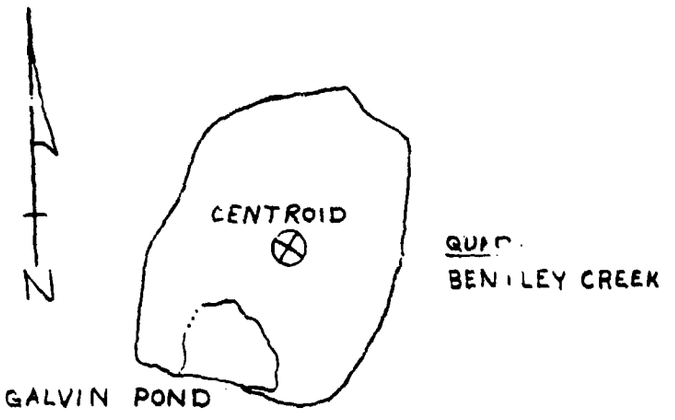
DAM STORAGE

$V = h/3\,(A_1 + A_2 + \sqrt{A_1 A_2})$

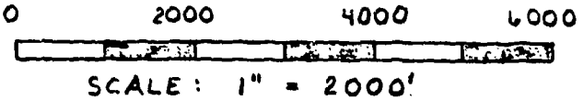
$V = \frac{6.9}{3}\,(13.30 + 18.80 + \sqrt{(13.30)(18.80)})$

$V = 110.$ Ac.-Ft.

DRAINAGE AREA = 0.30 Sq. Mi.



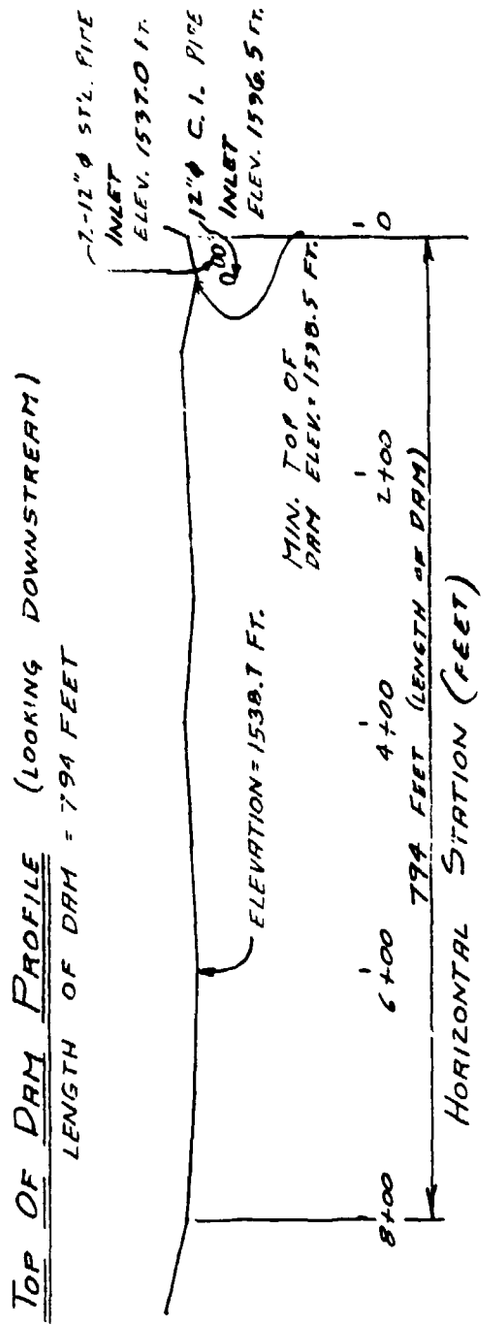
GALVIN POND DAM:
DRAINAGE AREA AND CENTROID MAP

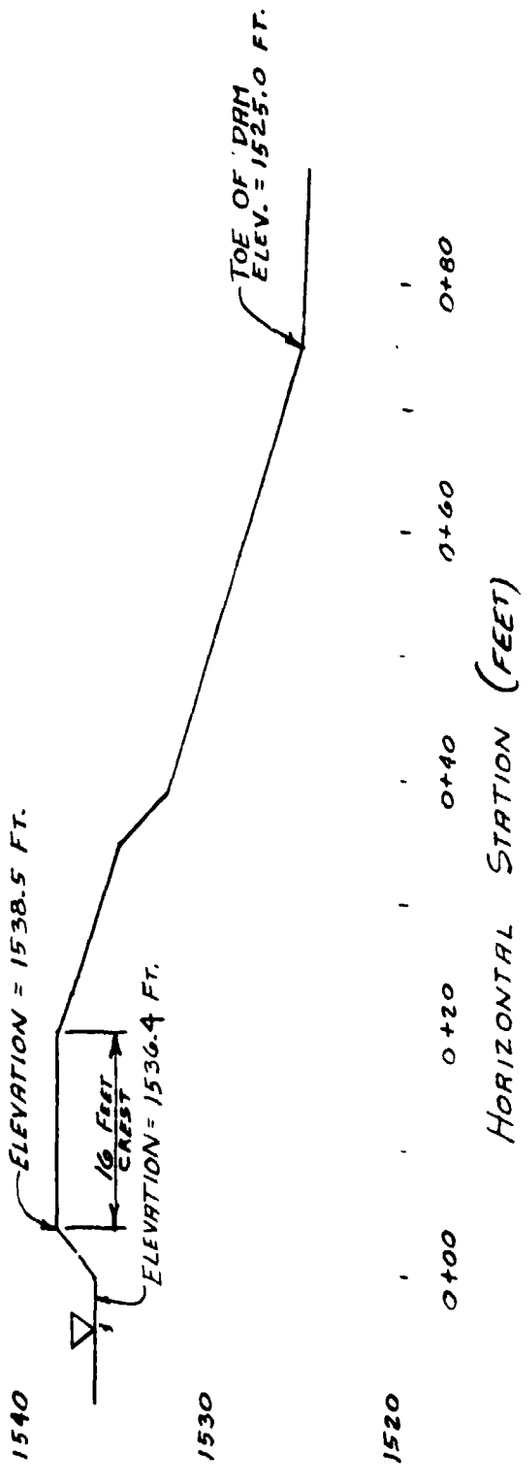


MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject GALVIN POND DAM — S.O. No. 13837-00-9RB-15
TOP OF DAM PROFILE — Sheet No. 4 of 13
TYPICAL CROSS SECTION — Drawing No.
Computed by GWT — Checked by — Date 11-18-80



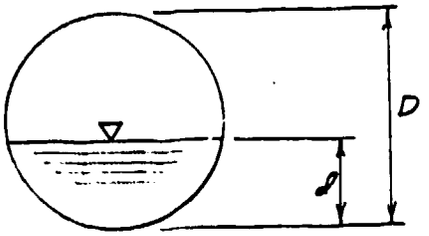


MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject GALVIN POND DAM — S.O. No.
12" STEEL PIPE RATING — Sheet No. 5 of 13
Drawing No.
Computed by GWT — Checked by WDL — Date 12-8-80

"DESIGN OF SMALL DAMS" PAGES 556 AND 559



D = PIPE DIA.
d = DEPTH OF WATER
S = PIPE SLOPE
$= \frac{1537.00 - 1536.46}{35} = 0.0126$ FT/FT
n = .012 STEEL PIPE

$\frac{d}{D} = \frac{.5}{1} = .5$ TABLE B-2 $1.3955 = \frac{Q_s}{D^{5/2}} = \frac{Q}{1^{5/2}}$ $Q = 1.395$ CFS

$\frac{d}{D} = \frac{.5}{1} = .5$ TABLE B-3 $0.232 = \frac{Q n}{D^{8/3} S^{1/2}} = \frac{Q(.012)}{1^{8/3}(.0126)^{1/2}}$ $Q = 2.17$ CFS

$\frac{d}{D} = \frac{.75}{1} = .75$ TABLE B-2 $3.0607 = \frac{Q_s}{D^{5/2}} = \frac{Q}{1^{5/2}}$ $Q = 3.06$ CFS

$\frac{d}{D} = \frac{.75}{1} = .75$ TABLE B-3 $.422 = \frac{Q n}{D^{8/3} S^{1/2}} = \frac{Q(0.012)}{1^{8/3}(.0126)^{1/2}}$ $Q = 3.95$ CFS

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS

Box 280
Beaver, Pa. 15009

Subject GALVIN POND DAM — S.O. No.
12" STEEL PIPE RATING — Sheet No. 6 of 13
Drawing No.
Computed by GWT — Checked by WDL — Date 12-9-80

ORIFICE FLOW

$Q = CA(2gH)^{.5}$

$Q = 3.78\,(H)^{.5}$

$A = \pi R^2 = \pi(.5)^2 = 0.785\ FT^2$

$g = 32.2\ FT/SEC^2$

H VARIES FROM 1 FT. TO 2.5 FT.

C = .60 FROM TABLE 4-6 P.4-32 BRATER + KING d = 1FT, L = 35 FT.

HEAD MEASURED TO CENTER OF PIPE

ELEVATION, (FT)	C	A, (FT^2)	2g FT/SEC^2	H, (FT)	Q, (CFS)	Q, 2 PIPES (CFS)
1538.5	.60	0.785	64.4	1.0	3.78	7.56
1539.0	.60	0.785	64.4	1.5	4.62	9.24
1539.5	.60	0.785	64.4	2.0	5.35	10.70
1540.0	.60	0.785	64.4	2.5	5.98	11.96

PIPE FLOW

$$Q = \frac{A(2gH)^{1/2}}{[1 + K_e + K_f + K_c(L)]^{1/2}}$$

$Q = 3.82\,(H)^{1/2}$

ELEVATION, (FT.)	H, (FT)	Q, (CFS)	Q, 2 PIPES (CFS)
1538.5	0.94	3.70	7.40
1539.0	1.44	4.58	9.16
1539.5	1.94	5.32	10.64
1540.0	2.44	5.96	11.92

$A = \pi R^2 = 0.785\ FT^2$

$g = 32.2\ FT/SEC^2$

H VARIES AND IS MEASURED FROM THE TOP OF PIPE ELEV. AT THE OUTLET.

L = 35 FT.

$K_e\ (K_e) = 0.78$ PG. 5.5-6 SCS NEH-5

$K_b\ (K_f) = 0$ PG. 5.5-10 SCS NEH-5

$K_c\ (K_f) = .0267$ PG. 5.5-4 SCS NEH-5

$n = 0.012$

TOP OF 12" DIA. PIPE AT OUTLET ELEV. = 1538.06 FT.

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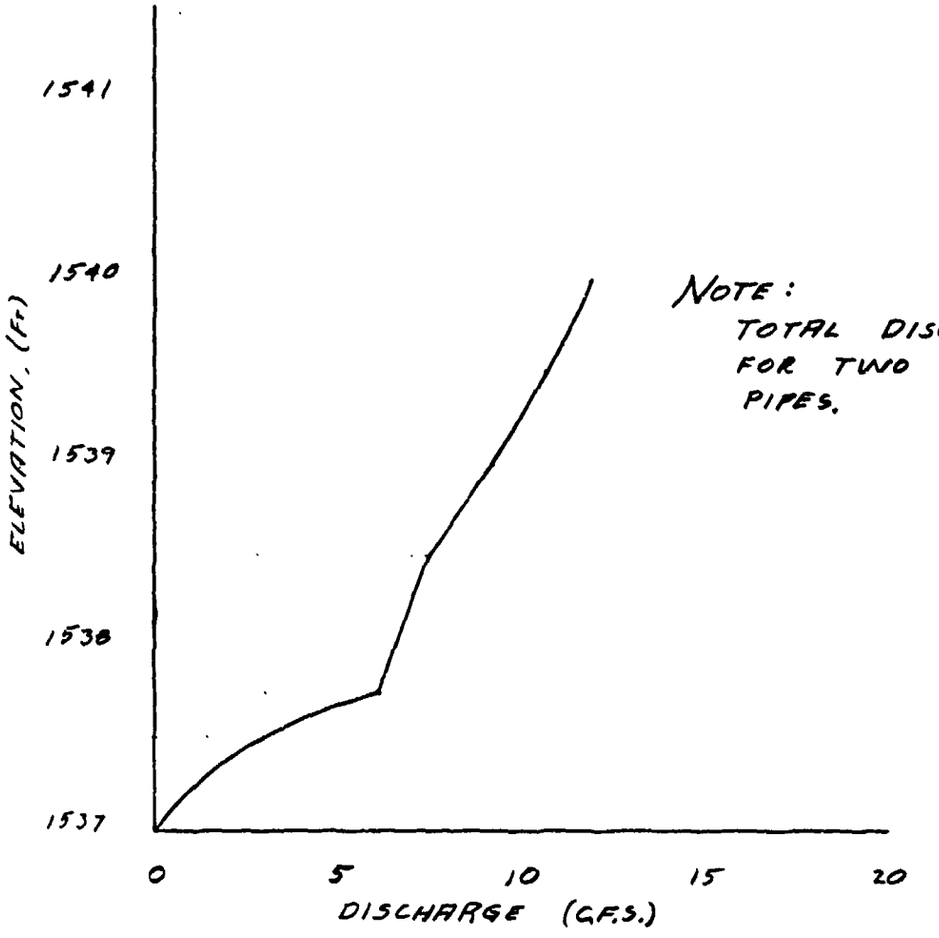
Subject GALVIN POND DAM S.O. No.
12" STEEL PIPE RATING CURVE Sheet No. 7 of 13
Drawing No.
Computed by GWT Checked by WDL Date 12-9-80



NOTE:
TOTAL DISCHARGE FOR TWO 12" ϕ PIPES.

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Box 280
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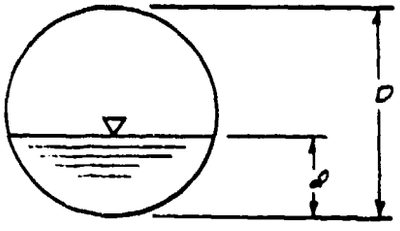
Subject GALVIN POND DAM . S.O. No.
12" CAST IRON PIPE RATING Sheet No. 8 of 13
Drawing No.
Computed by GWT Checked by WDL Date 12-9-80

"DESIGN OF SMALL DAMS" PAGES 55E AND 559



D = PIPE DIA.
d = DEPTH OF WATER
S = PIPE SLOPE
$= \frac{1536.5 - 1536.06}{35} = 0.0126$ FT/FT.
n = 0.014 CAST IRON PIPE

$\frac{d}{D} = \frac{.5}{1} = .5$ TABLE B-2 $1.3955 = \frac{Q_c}{D^{5/2}} = \frac{Q}{1^{5/2}}$ $Q = 1.395$ CFS

$\frac{d}{D} = \frac{.5}{1} = .5$ TABLE B-3 $0.232 = \frac{Q_n}{D^{8/3} S^{1/2}} = \frac{Q(.014)}{1^{8/3}(.0126)^{1/2}}$ $Q = 1.86$ CFS

$\frac{d}{D} = \frac{.75}{1} = .75$ TABLE B-2 3.0607 $\frac{Q_c}{D^{5/2}} = \frac{Q}{1^{5/2}}$ $Q = 3.06$ CFS

$\frac{d}{D} = \frac{.75}{1} = .75$ TABLE B-3 $.422 = \frac{Q_n}{D^{8/3} S^{1/2}} = \frac{Q(.014)}{1^{8/3}(.0126)^{1/2}}$ $Q = 3.38$ CFS

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Subject GALVIN POND DAM — S.O. No.
12" CAST IRON PIPE RATING — Sheet No. 9 of 13
Drawing No.
Computed by GWT — Checked by WDL — Date 12-9-80

ORIFICE FLOW

$Q = CA(2gH)^{1/2}$

$Q = 3.78(H)^{1/2}$

$A = \pi R^2 = \pi(.5)^2 = 0.785$ FT^2
$g = 32.2$ FT/SEC^2
H VARIES FROM 1 FT TO 3 FT.
C = .60 FROM TABLE 4-6
p. 4-32 BRATER + KING
d = 1 FT., L = 35 FT.

HEAD MEASURED TO CENTER OF PIPE

ELEVATION, (FT)	C	A, (FT^2)	2g, (FT/SEC^2)	H, (FT)	Q, (CFS)
1538.0	0.6	0.785	64.4	1.0	3.78
1538.5	0.6	0.785	64.4	1.5	4.63
1539.0	0.6	0.785	64.4	2.0	5.35
1539.5	0.6	0.785	64.4	2.5	5.98
1540.0	0.6	0.785	64.4	3.0	6.55

PIPE FLOW

$$Q = \frac{A(2gH)^{1/2}}{[1 + K_e + K_b + K_c(L)]^{1/2}}$$

$Q = 3.61(H)^{1/2}$

$A = \pi R^2 = 0.785$
$g = 32.2$ FT/SEC^2
H VARIES AND IS MEASURED FROM THE TOP OF PIPE ELEV. AT THE OUTLET.
L = 35 FT.
K_e (K_o) = .78 Pg 5.5-6 SCS NEH-5
K_b (K_s) = 0 Pg 5.5-10 SCS NEH-5
K_c (K_f) = 0.0363 Pg. 5.5-4 SCS NEH-5
n = 0.014
TOP OF 12" DIA. PIPE AT OUTLET ELEV. = 1537.56 FT.

ELEVATION, (Ft)	H, (FT)	Q, (CFS)
1538.0	0.94	3.50
1538.5	1.44	4.33
1539.0	1.94	5.03
1539.5	2.44	5.64
1540.0	2.94	6.19

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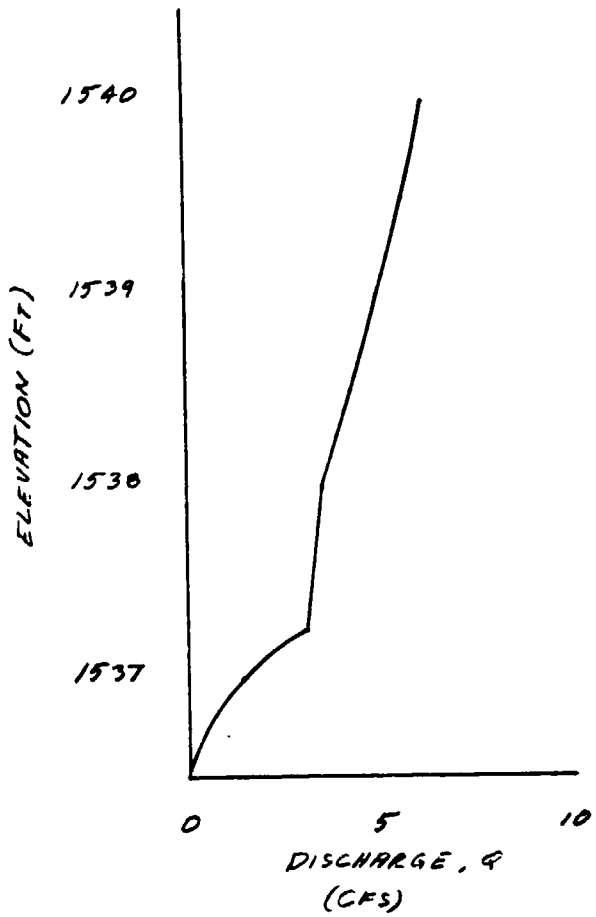
Subject GALVIN POND DAM S.O. No.

12" CAST IRON PIPE RATING CURVE Sheet No. 10 of 13

Drawing No.

Computed by GWT Checked by WDL Date 12-9-80



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Beaver, Pa. 15009

Subject GALVIN POND DAM S.O. No.
PIPE RATING SUMMARY Sheet No. 11 of 13
Drawing No.
Computed by GWT Checked by WDL Date 12-9-80

ELEVATION, (FT)	12" STEEL PIPE Q (CFS)	12" CAST IRON PIPE Q (CFS)	TOTAL Q (CFS)
1536.5	0	0	0
1537.0	0	1.39	1.39
1537.25	1.25	3.06	4.31
1537.5	2.78	3.25	6.03
1537.75	6.12	3.40	9.52
1538.0	6.60	3.50	10.10
1538.5	7.40	4.33	11.73
1539.0	9.16	5.03	14.19
1539.5	10.64	5.64	16.28
1540.0	11.92	6.19	18.11

SPILLWAY CAPACITY AT THE MINIMUM TOP OF THE DAM (ELEV. 1538.5 FT.) IS 11.73 C.F.S.

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Beaver, Pa. 15009

Subject GALVIN POND DAM — S.O. No.
100-YEAR DISCHARGE — Sheet No. 12 of 13
CALCULATION — Drawing No.
Computed by GMT — Checked by WDV — Date 12-9-80

THE INFLOW TO THE IMPOUNDMENT FOR THE 100-YEAR FLOOD WAS CALCULATED USING THE MATERIAL FROM "THE HYDROLOGIC STUDY - TROPICAL STORM AGNES" PREPARED BY THE SPECIAL STUDIES BRANCH, PLANNING DIVISION, NORTH ATLANTIC DIVISION, CORPS OF ENGINEERS, IN NEW YORK CITY.

① COMPUTE THE MEAN LOGARITHM

$LOG(Q_m) = C_m + 0.75 \ LOG\ A$

$LOG(Q_m)$ = MEAN LOGARITHM OF ANNUAL FLOOD PEAKS
A = DRAINAGE AREA, Sq. Mi, = 0.30 Sq. Mi.
C_m = MAP COEFFICIENT FOR MEAN LOG OF ANNUAL PEAKS FROM FIG. 21 = 2.2

$LOG(Q_m) = 2.2 + 0.75\ LOG(0.30)$
$= 1.8078$

② COMPUTE STANDARD DEVIATION

$S = C_s - 0.05\ (LOG A)$

S = STANDARD DEVIATION OF THE LOGARITHMS OF THE ANNUAL PEAKS.
C_s = MAP COEFFICIENT FOR STANDARD DEVIATION FROM FIG. 22 = 0.381
A = DRAINAGE AREA, SQ. Mi = 0.30 Sq. Mi.

$S = 0.381 - 0.05\ LOG\ 0.30$
$= 0.4071$

③ SELECT SKEW COEFFICIENT FROM FIG. 23 = 0.28

④ $LOG(Q_{100}) = LOG(Q_m) + K(P,g)S$

K(P,g) = STANDARD DEVIATE FOR A GIVEN EXCEEDENCE FREQUENCY PERCENTAGE (P) AND SKEW COEFFICIENT (g) FROM EXHIBIT 39 OF BEARD'S "STATISTICAL METHODS IN HYDROLOGY" = 2.536

$LOG(Q_{100}) = 1.8078 + 2.536(0.4071)$
$= 2.8402$
$Q_{100} = 692.16$ CFS

MICHAEL BAKER, JR., INC.
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Box 280
Beaver, Pa. 15009

Subject GALVIN POND DAM S.O. No.
100-YEAR DISCHARGE CALCULATION Sheet No. 13 of 13
Drawing No.
Computed by GWT Checked by WDC Date 6/19/81

THE INFLOW TO THE IMPOUNDMENT FOR THE 100-YEAR FLOOD WAS CALCULATED USING MATERIAL FROM "WATER RESOURCES BULLETIN, BULLETIN NO. 13, FLOODS IN PENNSYLVANIA", PREPARED BY THE DEPARTMENT OF ENVIRONMENTAL RESOURCES, COMMONWEALTH OF PENNSYLVANIA.

DRAINAGE BASIN FROM PLATE 2 – MODEL 2

REGRESSION EQUATION FROM TABLE 2

$Q_T = CA^X$

T = 100 YEARS
C = 564
A = DRAINAGE AREA, 0.30 Sq. Mi.
X = 0.744

$Q_{100} = 564 (0.30)^{0.744}$

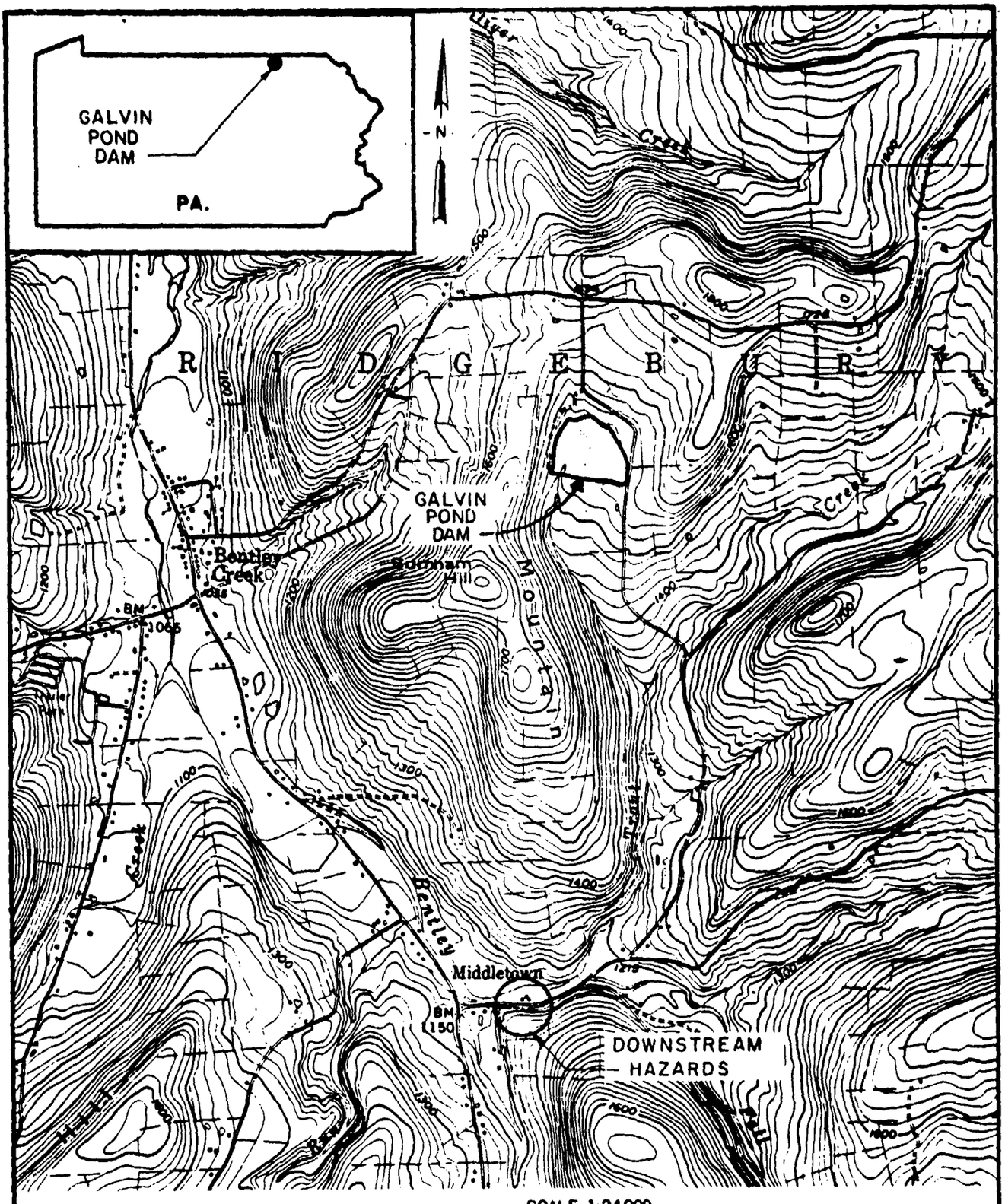
$Q_{100} = 230$ C.F.S.

AVERAGING THE INFLOW FROM THIS METHOD AND THE PREVIOUS METHOD GIVES AN INFLOW OF 461 C.F.S. TO THE IMPOUNDMENT.

APPENDIX E

PLATES

CONTENTS



SCALE 1:24000

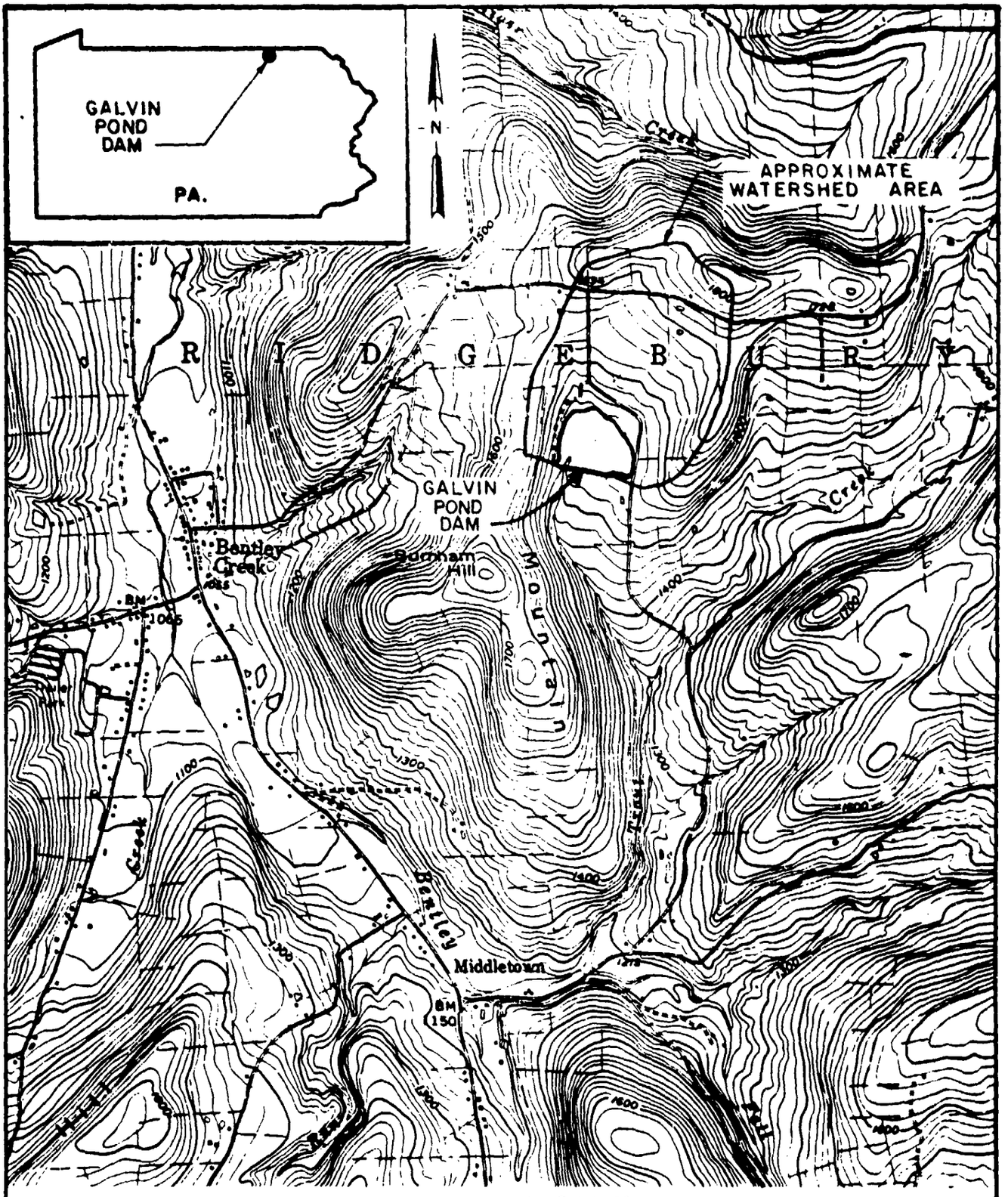
1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

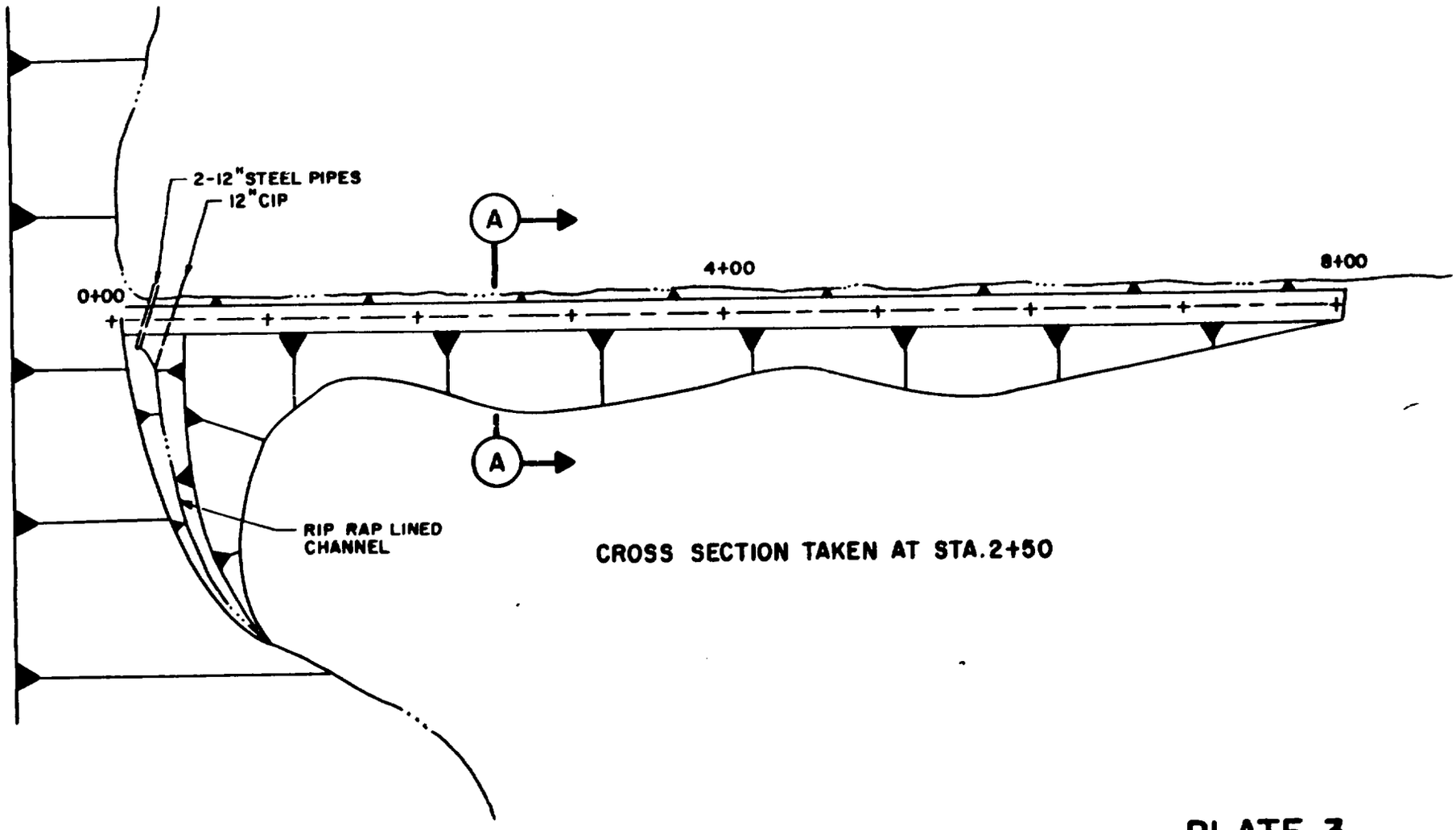
REFERENCES:
1. U.S.G.S. 7.5' BENTLEY CREEK, PA. QUADRANGLE. PHOTOREVISED 1969

PLATE 1 LOCATION PLAN
GALVIN POND DAM



REFERENCES:
1. U.S.G.S. 7.5 BENTLEY CREEK, PA. QUADRANGLE. PHOTOREVISED 1969

PLATE 2 WATERSHED MAP
GALVIN POND DAM



CROSS SECTION TAKEN AT STA.2+50

PLATE 3

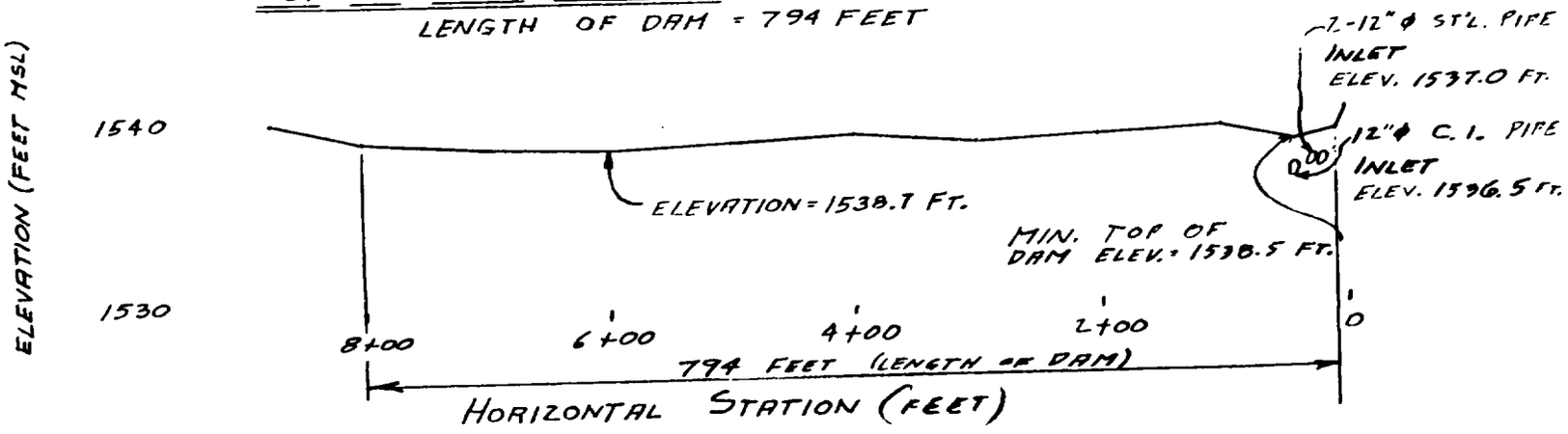
FIELD SKETCH

GALVIN POND DAM
NDI NO.PA00602
PennDER NO. 8-63
SCHEMATIC - NOT TO SCALE

MICHAEL BAKER, JR., INC.
THE BAKER ENGINEERS
Box 280
Beaver, Pa. 15009

TOP OF DAM PROFILE (LOOKING DOWNSTREAM)

LENGTH OF DAM = 794 FEET



TYPICAL CROSS SECTION AT STA. 2+50

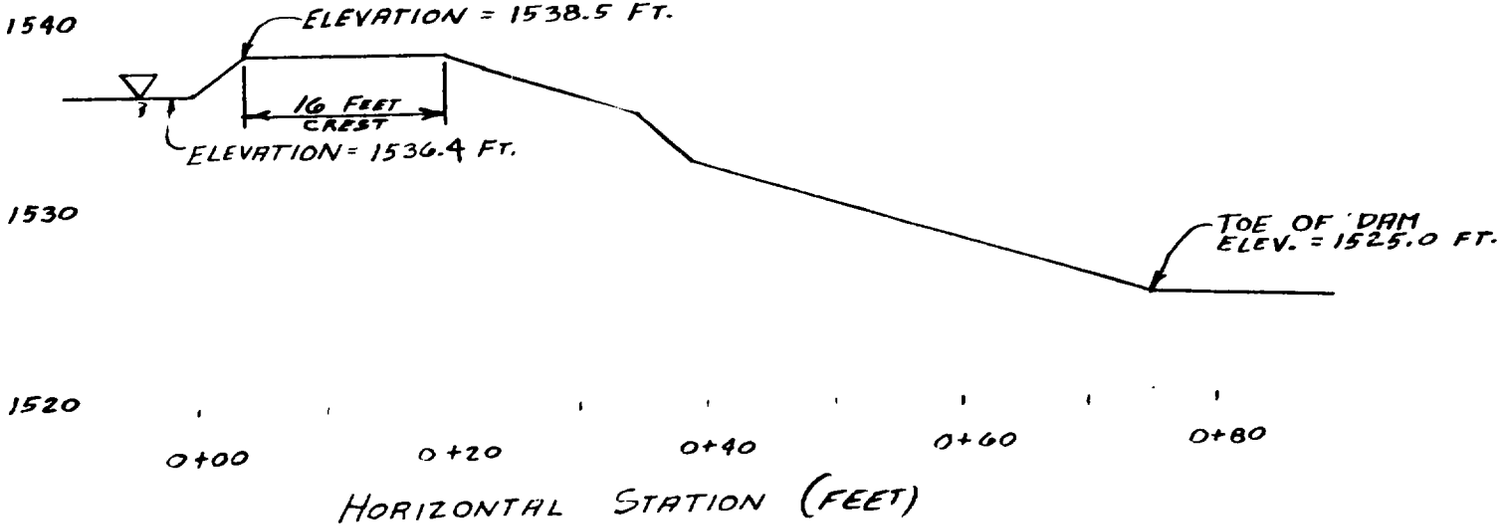


PLATE 4

APPENDIX F

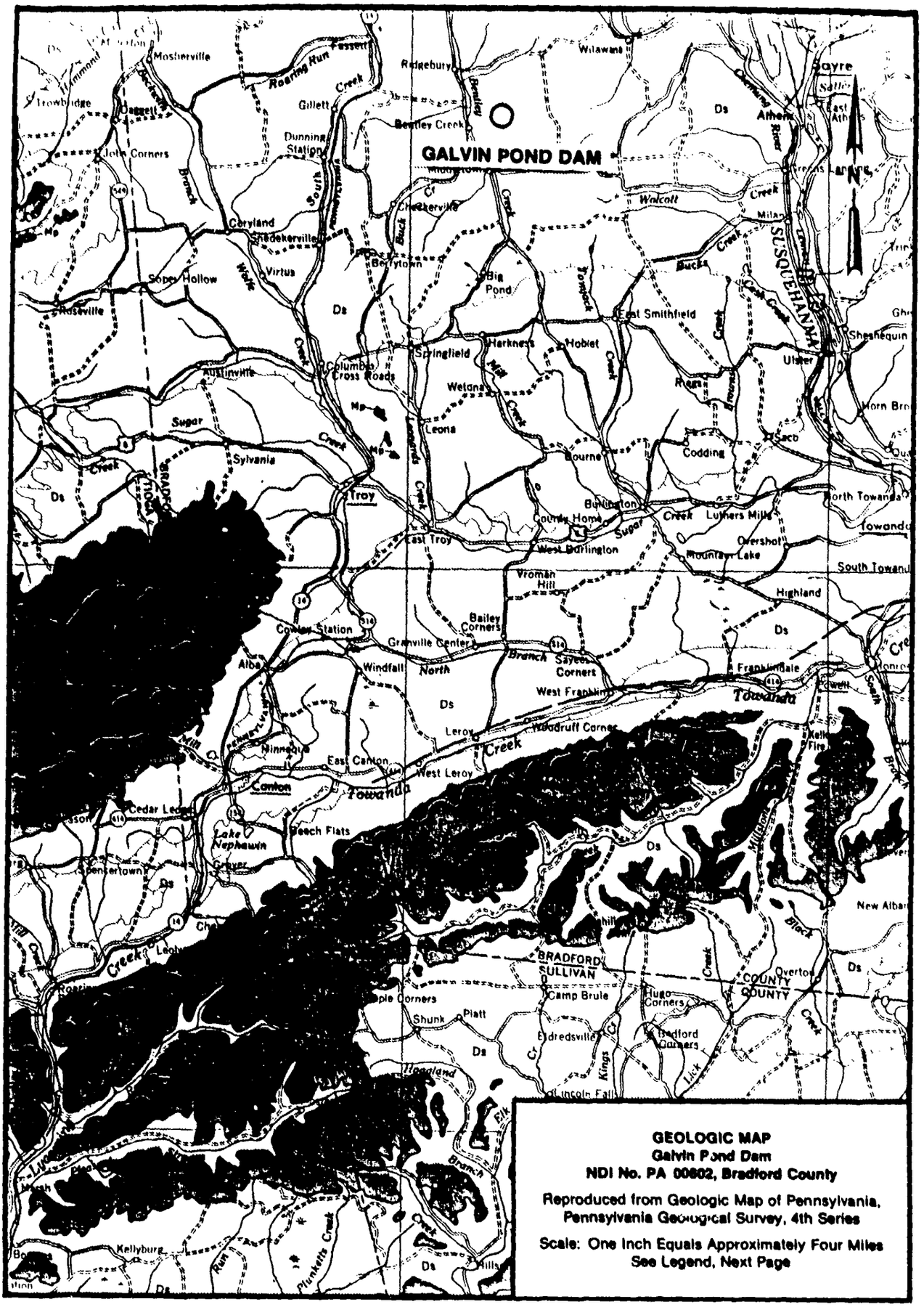
REGIONAL GEOLOGY

Galvin Pond Dam
NDI No. PA 00602, PennDER No. 8-63

REGIONAL GEOLOGY

Galvin Pond Dam is located in the Glaciated Low Plateaus Section of the Appalachian Plateaus physiographic province. Drainage is to the north via Bentley Creek and average relief in the area is about 500 feet. The area has been glaciated at least three times and is currently overlain with Wisconsin Stage glacial deposits. According to the Soil Conservation Service's Advance Soil Survey for Bradford County, the soils in the vicinity of the dam consist primarily of yellowish brown, stoney, silt loams of the Volusia-Mardin association. No test borings were available for review; thus, the thickness of overburden is difficult to ascertain.

Geologic references indicate that bedrock in the vicinity of the dam consists of members of the Chemung Formation in the Susquehanna Group. The Chemung is composed of prodelta, fossiliferous, gray sandstones and siltstones of Upper Devonian age. The dam is situated atop the south flank of the Wellsboro Anticline; thus, strata is dipping 1-2° to the south.



GEOLOGIC MAP
Galvin Pond Dam
NDI No. PA 00802, Bradford County

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Scale: One Inch Equals Approximately Four Miles
See Legend, Next Page

GEOLOGY MAP LEGEND

DEVONIAN

UPPER

WESTERN PENNSYLVANIA

Oswayo Formation
Greenish gray to gray shales, siltstones and sandstones becoming increasingly shaly westward; considered equivalent to type Oswayo. Riceville Formation Dr *in Erie and Crawford Counties; probably not distinguishable north of Corry.*

Dcr

Cattaraugus Formation
Red, gray and brown shale and sandstone with the proportion of red decreasing westward; includes Venango sands of drillers and Salamanca sandstone and conglomerate; some limestone in Crawford and Erie counties.

Conneaut Group
Alternating gray, brown, greenish and purplish shales and siltstones; includes "pink rock" of drillers and "Chemung" and "Girard" Formations of northwestern Pennsylvania.

Dcn

Canadaway Formation
Alternating brown shales and sandstones; includes "Portage" Formation of northwestern Pennsylvania.

CENTRAL AND EASTERN PENNSYLVANIA

Oswayo Formation
Brownish and greenish gray, fine and medium grained sandstones with some shales and scattered calcareous lenses; includes red shales which become more numerous eastward. Relation to type Oswayo not proved.

Dck

Catskill Formation
Chiefly red to brownish shales and sandstones; includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east.

Dm

Marine beds
Gray to olive brown shales, graywackes, and sandstones; contains "Chemung" beds and "Portage" beds including Burket, Brallier, Harrell, and Trimmers Rock; Tully Limestone at base.

Ds

Susquehanna Group
Barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey County reports; barbs on "Chemung" side of line.

MIDDLE AND LOWER

Db

Hamilton Group

Mahantango Formation
Brown to olive shale with interbedded sandstones which are dominant in places (Montebello); highly fossiliferous in upper part; contains "Centerfield coral bed" in eastern Pennsylvania.

Marcellus Formation
Black, fissile, carbonaceous shale with thick, brown sandstone (Turkey Ridge) in parts of central Pennsylvania.

Onondaga Formation
Greenish blue, thin bedded shale and dark blue to black, medium bedded limestone with shale predominant in most places; includes Selinsgrove Limestone and Needmore Shale in central Pennsylvania and Buttermilk Falls Limestone and Esopus Shale in easternmost Pennsylvania; in Lehigh Gap area includes Palmerton Sandstone and Bowmanstown Chert.

Dmu

Oriskany Formation
White to brown, fine to coarse grained, partly calcareous, locally conglomeratic, fossiliferous sandstone (Ridgeley) at the top; dark gray, cherty limestone with some interbedded shales and sandstones below (Shriver).

Helderberg Formation
Dark gray, calcareous, thin bedded shale (Mandata) at the top, equivalent to Port Ewen Shale and Becraft Limestone in the east; dark gray, cherty, thin bedded, fossiliferous limestone (New Scotland) with some local sandstones in the middle; and, at the base dark gray, medium to thick bedded, crystalline limestone (Coeymans), sandy and shaly in places with some chert nodules.